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09/848,397	05/03/2001	Yi Ding	200-0720	7721

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FORD GLOBAL TECHNOLOGIES, LLC.  
SUITE 600 - PARKLANE TOWERS EAST  
ONE PARKLANE BLVD.  
DEARBORN, MI 48126

EXAMINER

YUAN, DAH WEI D

ART UNIT

PAPER NUMBER

1745

DATE MAILED: 06/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Applicati n N .

09/848,397

Applicant(s)

DING ET AL.

Examin r

Dah-Wei D. Yuan

Art Unit

1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1,4,10,12,20 and 25-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 25 and 27-29 is/are allowed.
- 6) ☒ Claim(s) 1,4,10,12,20 and 26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

**FUEL CELL POWER PLANT WITH ELECTROCHEMICAL  
ENHANCED CARBON MONOXIDE REMOVAL**

Examiner: Yuan

S.N. 09/848,397

Art Unit: 1745

June 11, 2003

**Detailed Action**

1. The Applicant's amendment filed on May 6, 2003 was received. Claims 2,3,5-9,11,13-19,21-24 were cancelled. Claims 1,4,10,12,20 were amended. Claims 25-29 were added.
2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action (Paper No. 4).

***Specification***

3. The amendment filed on May 6, 2003 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: removal system providing rapid dynamic response over a temperature range of 0 to 800 (850) degrees Celsius.

Applicant is required to cancel the new matter in the reply to this Office Action.

***Claim Rejections - 35 USC § 112***

4. The claim rejections under 35 U.S.C. 112, second paragraph, on claims 2-24 are withdrawn, because claim 2 has been cancelled.

Art Unit: 1745

5. Claims 1,4,10,12,20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. The term "rapid dynamic response" in claim 1 is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claims 1,4,10,12,20,26 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The recitations "...over a temperature range of 0 to 800 degrees Celsius" and "...over a temperature range from 0 to 850 degrees Celsius" in claims 1 and 26, respectively, are not disclosed in the instant specification. This deficiency renders the examination impractical because of the critical nature of the aforementioned term. For the interest of compact prosecution, claim 1 is examined as reciting "...over elevated temperatures...".

***Claim Rejections - 35 USC § 103***

9. Claims 1,10,12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rehg et al. (US 6,245,214) in view of Vayenas (Ionic and Mixed Conducting Ceramics, 509-529 (1998)).

Rehg et al. teach a fuel cell system comprising a CO removal system and a fuel cell stack. In general, a hydrocarbon fuel source, such as gasoline, natural gas or methanol (hydrogen fuel), is introduced into a fuel processor. In the fuel processor, the hydrocarbons can react with air or water through partial oxidation or steam reforming to form a reformat mixture containing hydrogen, carbon monoxide, carbon dioxide, water and other minor components. The reformat mixture undergoes additional steps of catalytic reactions, such as a water-gas-shift reaction to further promote the reaction between steam and CO to form hydrogen and CO<sub>2</sub>. See Column 5, Lines 26-40; Figure 1.

However, Rehg et al. do not teach the use of electrochemical promotion to remove the CO in the reactant. Vayenas et al. teach a non-Faradaic electrochemical modification of catalytic activity using ionic and mixed conducting ceramics. It is found that the catalytic activity and selectivity of metal films deposited on solid electrolytes can be altered dramatically and reversibly by applying an electrical current or potential between the metal catalyst film and a second film deposited on the solid electrolyte. One of the technological possibilities is in exhaust gas treatment. As a result, the controlled migration of ions from the electrolyte to a gas-exposed catalyst electrode surface under the influence of current can reduce the CO. In one embodiment, the electrochemical promotion is carried out at 370°C. Therefore, it would have been obvious to one of ordinary skill in the art to use electrochemical promotion to remove CO

in the fuel cell system of Rehg et al., because Vayenas et al. teach the non-Faradaic electrochemical modification can significantly improve the catalytic activity and, thus the efficiency of CO removal. With respect to claim 10, battery, potentiostat and galvanostat are considered functionally equivalent power sources. Therefore, it would have been obvious to one of ordinary skill in the art to substitute a DC battery for the potentiostat (or the galvanostat) to provide power in the CO removal system of Vayenas et al. With respect to claim 12, Vayenas et al. teach the working electrode, the solid electrolyte, the counter electrode and the power source are connected in series. Pages 509-511, 522.

10. Claims 1,4,10,12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rehg et al. (US 6,245,214) in view of Yentekakis et al. (Ionics, 1(5&6), 491-498 (1995)).

Rehg et al. teach a fuel cell system comprising a CO removal system and a fuel cell stack. In general, a hydrocarbon fuel source, such as gasoline, natural gas or methanol (hydrogen fuel), is introduced into a fuel processor. In the fuel processor, the hydrocarbons can react with air or water through partial oxidation or steam reforming to form a reformat mixture containing hydrogen, carbon monoxide, carbon dioxide, water and other minor components. The reformat mixture undergoes additional steps of catalytic reactions, such as a water-gas-shift reaction to further promote the reaction between steam and CO to form hydrogen and CO<sub>2</sub>. See Column 5, Lines 26-40; Figure 1.

However, Rehg et al. do not teach the use of electrochemical promotion to remove the CO in the reactant. Yentekakis et al. teach the rates of CO, H<sub>2</sub>, CO<sub>2</sub> and carbon formation

exhibit pronounced non-Faradaic or electrochemical promotion behavior at 750° to 950°C. It is found that the catalytic activity of CO can be altered by applying an electrical current or potential between the metal catalyst film and a second film deposited on the solid electrolyte. Figures 7-10 show the activity of CO can be decreased by promoting the deposition of carbon in the fuel cell reactor of Figure 2. Therefore, it would have been obvious to one of ordinary skill in the art to use electrochemical promotion to remove CO in the fuel cell system of Rehg et al., because Yentekakis et al. teach the non-Faradaic electrochemical modification can significantly reduce the CO activity and, thus improve the efficiency in the removal of CO. With regards to claim 4, the working electrode is a Ni (catalyst) deposited on YSZ cermet. With regards to claim 10, a galvanostat or potentiostat is used to apply constant currents or constant potentials (voltage) between the catalyst and counter electrode (see figure 2). The potentiostat, galvanostat and battery are considered functionally equivalent power sources. Therefore, it would have been obvious to one of ordinary skill in the art to substitute a battery for the potentiostat (or a galvanostat) to provide power in the CO removal system of Yentekakis et al. With respect to claim 12, Yentekakis et al. teach the working electrode, the solid electrolyte, the counter electrode and the power source are connected in series. See Abstract, Pages 491-493,496-498; Table 1.

***Allowable Subject Matter***

11. Claims 25,27-29 are allowed. The following is a statement of reasons for the indication of allowable subject matter: The invention of independent claim 25 recites a fuel cell system

comprising a source of hydrogen fuel, and a CO removal system using non-Faradaic electrochemical modification of catalyst activity, where the catalyst is selected from the group consisting of Cu/ZnO, Cu/CuO,  $\text{ABO}_3$  (perovskite) and zeolite. The closest prior arts of record, Vayenaas and Yentekakis, do not teach or suggest the use of the aforementioned catalysts in the CO removal system.

***Response to Arguments***

12. Applicant's arguments filed on May 6, 2003 have been fully considered but they are not persuasive.

*Applicant's principle arguments are*

*Claim 1 has been amended to recite the specific components of the CO removal system and to specify the operating temperatures of 0 to 800°C.*

In response to Applicant's arguments, please consider the following comments.

The components, including a working electrode, a counter electrode, an electrolyte and a power source, are disclosed in both the Vayenaas and Yentekakis references. The temperature limitation is not supported or discussed in the instant disclosure. Instead, the specification only teaches a temperature range, i.e., room temperature to 850°C, which is recited in the prior art.

See Page 10.



Art Unit: 1745

***Conclusion***

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dah-Wei D. Yuan whose telephone number is (703) 308-0766. The examiner can normally be reached on Monday-Friday (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (703) 308-2383. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Art Unit: 1745

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Dah-Wei D. Yuan  
June 11, 2003



**CAROL CHANEY**  
**PRIMARY EXAMINER**